Astrophysics

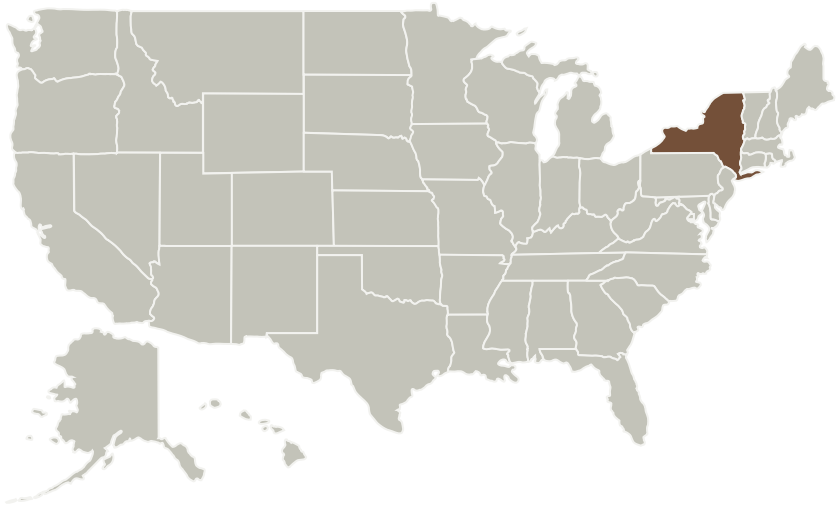
Lumped-Element Kinetic Inductance Detectors for Cosmic Microwave Background Polarimetry

Completed Technology Project (2016 - 2017)

Project Introduction

NASA's Science Mission Directorate (SMD) calls out understanding how the universe began as a major goal. The Cosmic Microwave Background (CMB) is a nearly isotropic radiation that fills the universe and contains unique cosmological information. The CMB contains polarization anisotropies and a measurement of the primordial B-mode polarization signal from inflationary gravitational waves could uniquely confirm the theory of inflation. In order to make this measurement, thousands of detectors with photon-noise limited sensitivity are needed. The NESSF fellowship has enabled me to work on the development of Lumped Element Kinetic Inductance Detectors (LEKIDs) for measuring CMB anisotropies. Specifically, I am conducting research for dual-polarization LEKIDs that are sensitive to spectral bands in the millimeter wavelengths where the CMB spectrum peaks. In the first year of the NESSF fellowship, I accomplished all stated goals, most importantly to demonstrate sensitive dual-polarization LEKIDs with low noise. We have been invited to deploy the dual-polarization LEKIDs at the Keck Array, a B-mode polarization experiment, for an on-sky test in the coming year. I will be part of the team to integrate and deploy the detectors and to analyze the experimental data. Additionally, as part of a collaboration, I have begun work towards developing multichroic KIDs, meaning the detectors are simultaneously sensitive to multiple spectral bands, that could be used in future CMB missions. In this progress report, I give a summary of work accomplished and present the research plan for 2016-2017. This research works to fulfill the NASA objectives of 1. Developing technological advances for future missions and 2. Measuring or a setting an upper limit on the primordial B-mode polarization signal.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Responsible Program:

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Organizations Performing Work	Role	Type	Location
The Trustees of Columbia University in the City of New York	Supporting Organization	Industry	New York, New York

Primary U.S. Work Locations
New York

Project Management

Program Manager:

Joe Hill-kittle

Principal Investigator:

Bradley R Johnson

Co-Investigators:

Heather Horgan
Heather L Mccarrick

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes

Target Destination

Outside the Solar System